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CRUISE REPORT[1]

VESSEL: *Oscar Elton Sette*, Cruise OES-07-03 (OES-51)

CRUISE PERIOD: 21 April–13 May 2007

AREA OF OPERATION: Kealakekua Bay, Island of Hawaii, Cross Seamount, Penguin Banks, and control sites (Fig. 1)

TYPE OF OPERATION: The Simrad EK60 echosounder's transducers were calibrated in Kealakekua Bay, while oceanographic survey operations were conducted at Cross Seamount and at Penguin Banks (Fig. 1). All survey operations consisted of conductivity-temperature-depth (CTD) casts down to a maximum of 1,000 m, as well as "deep" (~500 m) and "shallow" (~120 m) Cobb trawls at predetermined stations. Bioacoustic backscattering and currents were continuously recorded during the entire cruise. Self-noise testing of the EK60 echosounder's 38kHz and 120kHz transducers were conducted during the transect from Honolulu to Kealakekua Bay (Fig. 1).

ITINERARY:

21 April — Start of cruise. Embark Réka Domokos, Melanie Abecassis, Anela Choy, Lisa De Forest, Mathieu Doray, Jeff Drazen, Bridget Ferriss, Donald Hawn, and Krystle Turkington. Depart Ford Island, Honolulu, at 0800 and proceed to Kealakekua Bay, Island of Hawaii. En route test Cobb trawl gear and conduct self-noise testing for the onboard Simrad EK60 bioacoustics instrument for the 38 kHz and 120 kHz frequencies.

22 April — Anchor in Kealakekua Bay and begin operations to calibrate the Simrad EK60 dual frequency split beam echosounder. Upon completion of the calibration, begin transect to Cross Seamount.

[1] PIFSC Cruise Report CR-07-009
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23 April	Arrive at Cross Seamount and begin oceanographic survey operations.
24 April	Abort oceanographic operations at Cross Seamount due to medical emergency and the need to pick up a part needed to fix the Cobb trawl so it can be operational again.
25 April	Arrive off Snug Harbor, Honolulu, drop off sick crew member, and pick up part needed for trawl winch. Depart for Cross Seamount.
26 April	Arrive at Cross Seamount and begin oceanographic survey operations.
27 April–10 May	Continue oceanographic survey operations at Cross Seamount.
10 May	Abort oceanographic operations due to medical emergency and begin transect to Honolulu.
11 May	Arrive off Snug Harbor, Honolulu, and drop off sick crew member. Depart Honolulu and transit to Penguin Banks.
11 May	Arrive at Penguin Banks and begin oceanographic survey operations.
11–13 May	Continue oceanographic survey operations at Penguin Banks.
13 May	Depart Penguin Banks and transit to Ford Island, Honolulu. Disembark Réka Domokos, Melanie Abecassis, Anela Choy, Lisa De Forest, Mathieu Doray, Jeff Drazen, Bridget Ferriss, Donald Hawn, and Krystle Turkington. End of cruise.

MISSIONS AND RESULTS:

A Conduct self-noise measurements of and calibrate the Simrad EK60 echosounder.

1. Background noise measurements of the 38 kHz and 120 kHz transducers were conducted approximately at lat. 20° 35’ N, long. 157° W, off the west coast of Maui. These measurements determine the depth at which various back scatter values are reliable for the two frequencies at various vessel speeds and propeller revolutions. Further, these tests determine whether the active noise in the acoustics data might be attributed to bubbles, as determined by the acoustic testing during July 2006, or to a chip in the propeller, as suggested by Egil Ona and Hans Petter Knudsen from the Institute of Marine Research in Bergen, Norway. The test site was chosen to be at least 1 nautical mile

offshore with calm seas and minimal currents, in at least 500 m depth water (the actual water depth was 1,300 m). The test consisted of taking background noise measurements for the two frequencies at 0, 40, 60, 80, 100, 120, 140, and 160 propeller/engine revolutions, corresponding to vessel speeds of 0, 0.4, 2.2, 4.3, 6.0, 7.4, 8.5, and 9.7 nmi per hour. The noise measurements were completed in about 2 hours with satisfactory results. These tests showed very low background noise levels in the EK60 data, consistent with results of previous noise tests. These tests confirmed that the active noise entering the acoustic data is the result of bubbles, as opposed to propeller noise.

2. Kealakekua Bay was chosen as an ideal site for the calibration of the 38 kHz and 120 kHz EK60 transducers due to its shallow, protected waters with no waves and minimal currents. Calibration of the EK60's transducers has been successfully carried out previously on three occasions (September 18, 2004, April 12, 2005, and November 16, 2005) in the same location. The calibration site was chosen in ~ 50 m waters with sandy, flat bottom, corresponding to the site used during the previous calibrations. Prior to calibration, both the bow and stern anchors were deployed to maintain a stable position during the procedure.

   The calibration involved the placement of a metal calibration sphere — with known acoustic characteristics — underneath the ship's hull-mounted transducers and recording the acoustic return from the sphere at positions that cover the entire circle of the transducers' beam. Since the 38 kHz and 120 kHz transducers are installed next to each other on a "pod" attached to the bottom of the ship's hull, the calibration recordings on the *Oscar Elton Sette* can be carried out once together for both frequencies, once for each pulse width. The position of the sphere is controlled by a three-reel electric system with monofilament lines leading from the reels to the sphere. The sphere can be centered below the transducers below the hull of the ship by placing two reels on the port side and one reel on the starboard side of the ship.

   The positioning of the calibration sphere within the transducers' beam involved NOAA certified divers bringing the line from one side of the ship to the other underneath the hull, so when the line was pulled up on board, the calibration sphere and the weight could be attached to all three lines then lowered back into the water. TS measurements of the sphere were recorded over the entire beam area and before accepting the results, it was ascertained that the calibration RMS-error was acceptable. The procedure took approximately 12 hours, after which anchors were pulled before sunset to begin the transit to Cross Seamount.

B. Estimate tuna and bottom fish biomass and obtain information on tuna movement patterns and distribution using the Simrad EK60 echosounder system.

A total of 61 transects were completed to collect bioacoustic data for the assessment of biomass, distribution, and movement patterns of both bigeye tuna and micronekton: 51 transects over Cross Seamount, 3 at Penguin Banks, and 7 at the control sites. Because of excessive bubble noise, both vessel speed and heading direction were severely limited, resulting in less than acceptable spatial and temporal resolution of data obtained during the cruise. The impact of bubble noise was exacerbated by the presence of fishermen, further limiting the spatial resolution by reducing access to crucial regions at Cross Seamount. As a result, bigeye tuna and bottom fish biomass estimation at Cross Seamount and Penguin Banks will not be possible with the data obtained during this cruise. However, the data will provide information on the movement patterns and distribution of nekton and micronekton at both of these study sites.

C. Assess the influence of the physical dynamics on the density and distribution of micronekton and primary productivity in the region. Accomplish this assessment by comparing information obtained on micronekton and primary productivity to results on the study of physical environment via CTD casts and continuous acoustic Doppler current profiler (ADCP) measurements.

1. At total of 24 CTD casts were conducted to obtain information on temperature, salinity, dissolved oxygen, and chloropigments. Discrete water samples were also collected at depths of 200 m, 150 m, 125 m, 100 m, 80 m, 65 m, 50 m, 35 m, 20 m, and the surface for chloropigment determinations.

   Of the 24 casts, 18 were conducted at Cross Seamount, 4 at Penguin Banks, and 2 at Control sites. The first CTD cast was taken down to approximately 3500 m depth to be able to spool the cable back up under appropriate tension to correct coils and twists in the cable sitting on the CTD winch drum. All CTD operations were completed successfully, except bottle #7 (50 m depth) during Cast #2 and bottle #9 (20 m depth) during Cast #3 did not close, so no water samples were collected at those depths.

2. During the cruise, a total of 61 transects were completed with continuous ADCP recordings.

3. Sea-surface salinity information could not be collected during the entire cruise because the thermosalinograph was inoperable.

D. Conduct stern trawl operations targeting the depths of high sonic scattering layers to better our understanding of echosounder signals collected by the dual frequency EK60 echosounder system and to characterize the micronekton faunal composition and densities as the forage base for larger pelagic nekton.

Of the planned 23 Cobb trawls, a total of 14 were conducted during the cruise: 11 at Cross seamount and 3 at Control sites. Of these 14 trawls, 12 were successful while 2 had to be aborted. Aborted trawl #2 (a nighttime shallow trawl at a control site) did not deliver any samples, while aborted trawl #14, a daytime deep trawl near the flanks of Cross seamount, had to be aborted at net depth of 80 m, resulting in samples from the upper 80 m of the water column.

SCIENTIFIC PERSONNEL:

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Melanie Abecassis, Cooperating Scientist, Joint Institute for Marine and Atmospheric Research (JIMAR), University of Hawaii (UH)
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Krystle Turkington, Cooperating Scientist, JIMAR, Hawaii Pacific University

DATA COLLECTED:

The following forms, logs, charts, and data records were kept and given to the PIFSC upon termination of the cruise. These include all data captured onto computer storage media during the cruise. All the records are filed there unless indicated otherwise in parentheses.

CTD Station Log Sheet
Seabird CTD data files on DVD-R*
Marine Operations Log
Deck Log
Cobb Trawl Log
Northstar Netmind data files on DVD-R*
ADCP data files on DVD-R*
SCS data files (raw and compressed) on DVD-R*
XBT (SEAS) data files on DVD-R*

*All data files together on the same (1) DVD-R

(/s/Réka Domokos)

Submitted by: _____
Réka Domokos
Chief Scientist

(/s/Samuel G. Pooley)

Approved by: _____
Samuel G. Pooley
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Attachments

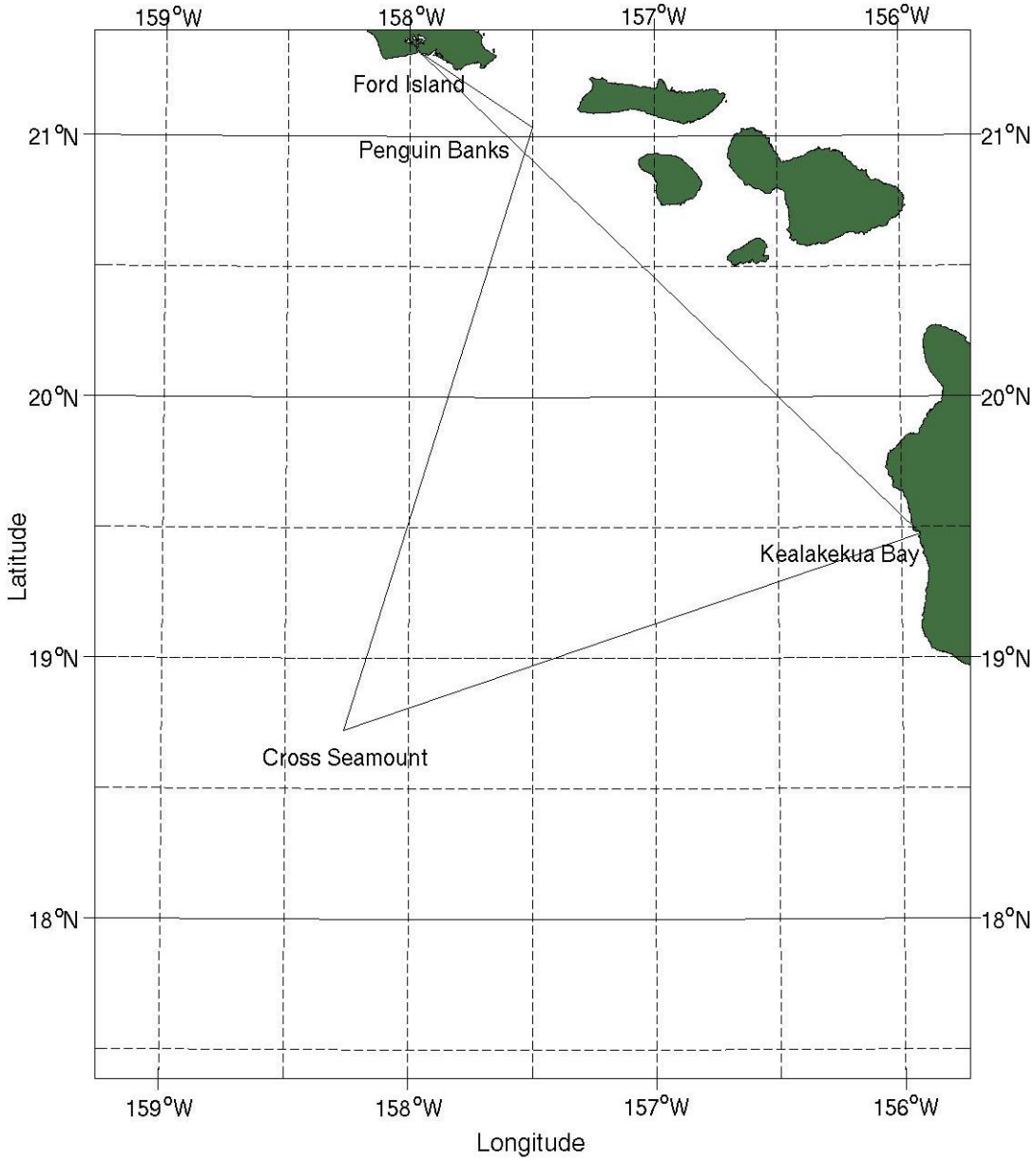

Figure 1. OES 07-03 (OES-51) cruise track, April 21 – May 13, 2007.